

**[Document Name] Claims**

**[Claim 1]**

A shredding machine for finely shredding a shredable object, comprising:  
a plurality of rotational shafts provided in parallel so as to support cutting blades in the transverse direction inside a shredder main body, wherein the cutting blade is provided with a plurality of cutting portions protruding from the peripheral of the cutting blade, and the cutting blades are disposed in the shaft direction of the rotational shafts so that the cutting portions engage with each other;

a throw-in port for the shredable object provided in an upper portion of the shredder main body; and

a discharge port for the shredable object provided in a lower portion of the shredder main body;

wherein in order to finely crush the shredable object thrown into the throw-in port, inside the shredder main body, the discharge port is disposed so as to be offset in the shaft direction of the rotational shafts with respect to the throw-in port so that the shredable object is scraped up from the lower portion to the upper portion while being traversed from a throw-in port side to a discharge port side, to crush the shredable object for a plurality of times.

**[Claim 2]**

The shredding machine of claim 1, wherein predetermined perforations are formed in the shredder main body below the throw-in port.

**[Claim 3]**

The shredding machine of claims 1 or 2, wherein a spiral traversing member is provided in an inner wall of the shredder main body so that it traverses the shredable object from the throw-in port side to the discharge port

side, while forwarding the shredable object from the lower portion on the throw-in port side toward the upper portion on the discharge port side.

**[Claim 4]**

The shredding machine of claim 3, wherein the spiral traversing member is configured to be a spiral protruded member for traversing that is provided on the inner wall of the shredder main body, up to approximately an upper end position of the cutting blade.

**[Claim 5]**

The shredding machine of any one of claims 1-4, wherein in order to traverse the shredable object from the throw-in port side to the discharge port side, a scrape-up member that protrudes from a tip-end of the cutting blade is provided so as to rotate with the cutting blade, and scrape up the shredable object from the lower portion on the throw-in port side toward the upper portion on the discharge port side.

**[Claim 6]**

The shredding machine of claim 5, wherein the scrape-up member is formed with an incline- surfaced cutting portion for scraping up the shredable object by a front surface thereof in the rotational direction, and for traversing the shredable object toward the discharge port side.

**[Claim 7]**

The shredding machine of claim 1, wherein the shredder main body is configured to be tilted by arranging that the throw-in port side of the shredder main body is higher than the discharge port side so that it traverses the shredable object from the throw-in port side to the discharge port side using the tilt thereof.

**[Claim 8]**

The shredding machine of claim 7, wherein the tilt angle of the shredder main body is configured to be variable by providing a driver for raising and lowering the throw-in port side or the discharge port side of the shredder main body.

**[Claim 9]**

The shredding machine of claims 7 or 8, wherein the shredding machine is for finely shredding a soft waste plastic as the shredable object, and wherein the shredder main body is configured tilt by approximately 8 degrees so that it crushes the soft waste plastic thrown into the throw-in port for a plurality of times by traversing the soft waste plastic toward the discharge port side while scraping up the soft waste plastic from the lower portion to the upper portion of the shredder main body.

**[Claim 10]**

The shredding machine of any one of claims 1-9, wherein the cutting blades are configured to be thinner on the discharge port side than on the throw-in port side so that a crush size of the shredable object is finer on the discharge port side.

**[Claim 11]**

The shredding machine of claim 10, wherein the thickness of the cutting blades between the throw-in port side and the discharge port side is configured to be thinner in a stepwise fashion from the throw-in port side.

**[Claim 12]**

The shredding machine of any one of claims 1-11, wherein the number of the cutting portions of the cutting blade on the discharge port side is configured

to be more than the number of the cutting portions of the cutting blade on the throw-in port side so that a crush size of the shredable object is finer on the discharge port.

**[Claim 13]**

The shredding machine of any one of claims 1-12, wherein the cutting blades are arranged so that the cutting portions are arranged in a spiral to traverse the shredable object from the throw-in port side to the discharge port side, by rotating.

**[Claim 14]**

The shredding machine of claim 1 or 2, wherein a diameter of the cutting blades on the discharge port side is smaller than a diameter of the cutting blades on the throw-in port side, and a thickness of the cutting blades on the discharge port side is thinner than a thickness of the cutting blades on the throw-in port side so that a crush size is finer.

**[Claim 15]**

The shredding machine of claim 1, wherein a lower portion of the shredder main body is configured to be of a damper gate type to open and close, and is configured so that an amount of the shredable object being discharged from the damper gate is adjustable by adjusting an amount of opening and closing the damper gate.

**[Claim 16]**

The shredding machine of claim 1, wherein the discharge port includes a plurality of discharge ports that are arranged between a position below the throw-in port in the shaft direction of the rotational shafts, each of the discharge ports is provided with an open/close door, respectively, and wherein the plurality

of open/close doors are configured to be open and close.

**[Claim 17]**

The shredding machine of claim 16, comprising a control device for adjusting a degree of opening of the open/close door according to a crush condition of the shredable object, or a power of the rotational shafts under load, or at a period of time.

**[Claim 18]**

The shredding machine of claim 1, wherein the discharge port that is offset with respect to the throw-in port in the shaft direction of the rotational shafts, is configured to be changeable to an arbitrary position between the offset position and the position below the throw-in port.

**[Claim 19]**

The shredding machine of claim 18, wherein a slide gate that is slidable in the shaft direction of the rotational shafts is provided to the discharge port, and the discharge port is configured to be formed in an arbitrary position by sliding the slide gate to open.

**[Claim 20]**

The shredding machine of claim 1, wherein a foreign object discharge port is provided to the lower portion or side portions of the shredder main body so as to be able to open and close, to discharge a foreign object mixed in the shredable object out of the crusher.

**[Claim 21]**

The shredding machine of claim 20, comprising a control device having a function to open the foreign object discharge port in the lower portion or the side

portions of the shredder main body, when an operational state measured value of the crusher is changed as the foreign object is thrown in.

**[Claim 22]**

The shredding machine of claims 20 or 21, wherein a foreign object pocket into which the foreign object enters is provided to the lower portion of the shredder main body, and the foreign object discharge port from which the foreign object being entered into the foreign object pocket is discharged is provided so as to open and close.

**[Claim 23]**

The shredding machine of claim 21, wherein a foreign object pocket into which the foreign object enters is provided to the lower portion of the shredder main body, and a foreign object discharge damper is provided to the foreign object pocket, and wherein an amount of opening and closing the foreign object discharge damper is configured to be controllable by the control device.

**[Claim 24]**

The shredding machine of claims 20 or 21, wherein a foreign object pocket into which the foreign object enters is provided to the lower portion of the shredder main body, and a foreign object pusher that extends in the foreign object pocket from the throw-in port side to the discharge port side is provided so that the foreign object that enters into the foreign object pocket is discharged from the discharge port by the foreign object pusher.

**[Claim 25]**

The shredding machine of claim 22, wherein the foreign object discharge port is constituted by a foreign object discharge slide gate that is slidable in the shaft direction of the shredder main body, and is configured so that the lower

portion of the foreign object pocket is openable by sliding the foreign object discharge slide gate.

**[Claim 26]**

The shredding machine of claims 20 or 21, wherein the foreign object discharge port is constituted by a foreign object discharge side damper for opening a side portion of the shredder main body, and the foreign object discharge side damper is configured to be openable so that the foreign object on an upper portion of the cutting blade is discharged outside the shredder main body.

**[Claim 27]**

The shredding machine of claim 1, wherein the throw-in port is provided in a central portion of the shredder main body in the shaft direction of the rotational shafts, the discharge ports are provided in both end portions of the shredder main body in the shaft direction of the rotational shafts, and the crusher is configured so that it crushes the shredable object thrown into the throw-in port for a plurality of times while it traverses the shredable object from the throw-in port side to both the discharge port sides and scrapes up the shredable object from the lower portion to the upper portion.

**[Claim 28]**

The shredding machine of any one of claims 1-27, comprising a driver for independently driving each of the plurality of rotational shafts; and a control device for making the driver independently rotate the plurality of rotational shafts at different rotational speeds.

**[Claim 29]**

The shredding machine of claim 28, wherein the control device includes a

function to drive the plurality of rotational shafts so as to interchange a high speed and a low speed at a predetermined interval.

**[Claim 30]**

The shredding machine of claim 28, wherein the control device includes a function to selectively perform one of drives of the plurality of rotational shafts among a normal rotation at the same rotational speed, a normal rotation of one rotational shaft at a low speed, and a reverse rotation of one rotational shaft at the low speed.

**[Claim 31]**

A shredding method, comprising:

shredding a shredtable object thrown into an upper body portion of a crusher at one end portion of the crusher in a shaft direction of rotational shafts that are disposed in parallel in the shaft direction of the rotational shafts, by cutting blades that engage with each other;

traversing the shredtable object toward the other end portion in the shaft direction of the rotational shafts while shredding the crushed shredtable object for a plurality of times by the cutting blades; and

discharging the crushed shredtable object from the other end portion in the shaft direction of the rotational shafts.

**[Claim 32]**

The shredding method of claim 31, wherein the shredtable object that is smaller than a predetermined perforation among the shredtable objects, and the shredtable object that is crushed first by the cutting blades and becomes smaller than the predetermined perforation are discharged at a position below the throw-in port; and wherein the shredtable object that is larger than the predetermined perforation is crushed for a plurality of times by the cutting blades



while being traversed toward the other end portion in the shaft direction of the rotational shafts.

**[Claim 33]**

The shredding method of claims 31 or 32, wherein the crushed shredable object is re-crushed between the cutting blades while being scraped up from the lower portion on the throw-in port side to the upper portion on the discharge port side.